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(54) One-sided cling stretch wrap.

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Description

The present invention is concerned with a stretch wrap film and, in particular, with a stretch wrap film suitable for spin wrapping applications wherein the film has a high degree of cling on one side thereof.

The use of thermoplastic stretch wrap for the overwrap packaging of goods, and in particular, the unitizing of pallet loads, is a commercially developing end use application for thermoplastic films including, generically, polyethylene. There are a variety of overwrapping techniques which are employed utilizing such stretch wrap films, including locating the pallet load to be wrapped atop a rotating platform. As the stretch wrap film is laid on about the girth of the pallet load, the pallet load is rotated on its platform. The stretch wrap is applied from a continuous roll thereof. Braking tension is applied to the continuous roll of film so that the film is being continuously stretched by the rotating pallet load. Usually the stretch wrap film, located adjacent to the rotating pallet load, is vertically positioned and the rotating platform or turntable may be operated at speeds ranging from 5 to 50 revolutions per minute. At the completion of the overwrap operation, rotation of the turntable is stopped while the film is cut and attached to the previous layer of film by, for example, tack sealing, adhesive tape or spray adhesives. Depending upon the width of the stretch wrap roll, the load being overlapped may be shrouded in the film while the vertically positioned film roll remains fixed in a vertical position. The vertically positioned film roll may also be arranged to move in a vertical direction as the load is being overwrapped whereby a spiral wrapping effect is achieved on the package goods.

It is known in the art to include cling additives in order to impart an increased cling force between two contacting films. For example, household cling wrap film which is used to cover dishes containing leftover food must have the ability to cling to the smooth glass, ceramic, and plastic surfaces. Examples of such cling wrap film are described in US—A—4,348,455 and 4,367,256. In each of these teachings the cling wrap additive, namely alkali metal dialkyl sulfosuccinate and glycerol oleates, respectively, is incorporated uniformly throughout the film so that the cling force on one side of the film is substantially the same as that of the other side of the film. The incorporation of such cling agents in a stretch wrap film employed for the unitizing of pallet loads presents a serious and expensive problem. While the employment of such a cling modified stretch wrap film will enhance and strengthen the bonding of the overlap film after the load has been stabilized there is the tendency of one stabilized load to cling or drag against an adjacent load causing transportation and handling problems. One overwrapped pallet load will then not slide against an adjacent load. The tendency is therefore for one load to pull destructively upon an adjacent load. As pallet loads are moved about by fork lift trucks, the stretch wrap film is pulled thereby destroying the integrity of the overwrap load.

It is an object to overcome this problem in an effective and economical manner.

In accordance with the present invention, a stretch wrap film having one sided cling comprises a thermoplastic A/B film structure wherein the exposed surface of layer A, in its stretched condition, has a comparatively high cling force to the exposed surface of layer B and the exposed surface of layer B has at least substantially no cling force to a layer of itself and has a slide property when the exposed surface of layer B is in contact with a layer of itself with relative motion therebetween. The base polymer of layer A comprises a thermoplastic polymer which in film form does not posssess a substantial cling force to a layer of itself. This layer is modified by the uniform dispersion therein of a cling additive in an amount sufficient to maintain film A in its stretched condition, in cling contact with layer B. Layer B contains an anticling additive of a character and in an amount sufficient to prevent at least any substantial cling force to a layer of itself. These films are preferably coextruded together so that in spite of the cling and anticling character of the individual films, the coextrusion at elevated temperature creates a bond at the interface thereof sufficiently strong such that during ordinary use the integrity of the interface is maintained. It is preferred that the film be transparent so that wrapped loads may be identified. by "transparent" it is meant that the film does not obscure the identity of the wrapped items. This therefore does not exclude a colored, tinted or opaque film. Other films or layers of specific function may be interposed between the A/B layers.

Any thermoplastic film capable of being fashioned into a stretch wrap film is contemplated for use herein. This film can be modified by the inclusion therein of prior art cling additives for one side of the stretch wrap film and any known anticling additives can be added to the same material. Alternatively, a different thermoplastic material can be employed for the noncling side of the film. While the noncling side of the film is of a character not to cling to itself or to any other noncling type surface there must be an effective cling between the cling type film of the present invention and the noncling film.

The pallet unitizing techniques described in US—A—3,986,611 and 4,050,221 are contemplated herein. Particularly preferred thermoplastic films suitable for use in the present invention are the polyolefins such as polyethylene, polypropylene, copolymers of ethylene and propylene, and polymers obtained from ethylene or propylene copolymerized with relatively minor amounts of other mono olefinic monomers such as butene-1, isobutylene, acrylic acids, esters of acrylic acids, vinyl acetate, styrene and the like or combinations thereof. Preferred is generically polyethylene, including, high and low molecular weight polyethylene and copolymers thereof. Particularly preferred for the cling film portion of the coextruded stretch film of the present invention is linear low density polyethylene (LLDPE). This material is a copolymer of ethylene with a C_4 to C_{10} olefin; for example, butene-1, 3-methyl-butene-1, hexene-1, 3-methyl-pentene-1, 4-methylpentene-1, 3-methyl-hexene-1, octene-1, decene-1 or a mixture thereof. The alpha-olefin is usually present in an amount from 1 to 10 weight percent of the copolymer. A typical manufacturing process for the formation thereof is disclosed in US—A—4076698 and 4205021. The preferred LLDPE has a density ranging from 0.905 to 0.940 g/cm^3. This material preferably has a melt index of from 1 to 6. This material will constitute the A layer of the subject coextruded A/B structure.

Similarly, while any thermoplastic non-cling film can be employed as the B layer of the A—B film structure, it is preferred that this layer also be a polyolefin. The B layer of the coextruded stretch wrap of the present invention is preferably fabricated from a low density polyethylene (LDPE) resin. This material will have a density ranging from 0.905 to 0.940 g/cm^3 and have a melt index ranging from 1 to 7. The cling side of the A—B film can contain any known cling agent uniformly dispersed therein to an extent effective to remain in cling contact with layer B while both are in the stretched condition. Examples of cling additives include, for example, polyisobutylene, having a number average molecular weight in the range of from 1000 to 3000 grams per mole as measured by a vapor phase osmometry. Other examples are amorphous atactic polypropylene having a number average M.W. of 2000, the polyterpenes and ethylene vinyl acetate copolymer. The cling additive can be present in the A layer in a concentration of from 0.5 to 10 pounds per 100 pounds of (0.5 to 10 kg per 100 kg) of resin.

The anti-cling additive present in the B layer of the subject coextrudate can be any effective antiblock capable of converting the B layer to an anti-cling film. Examples of effective materials are crystalline and amorphous silicas, silicates such as a synthetic sodium aluminum silicate (Na_2O Al_2O_3 SiO_2 $4H_2O$), diatomaceous earth and talc, which can be highly subdivided, having a particle size range of from 0.5 to 20 µm. These agents can be present in the B layer in a concentration of from 500 to 20,000 ppm, preferably from 2500 to 10,000 ppm. In forming the A—B layer coextrudate the A layer is preferably between 10% and 90% of the overall film thickness and the B layer is between 90 and 10% of the overall film thickness. Preferably the A thickness is 70%—90% of the total thickness.

In preparing the cling and noncling layers, it is contemplated to include therebetween any intermediate layer sufficient to prevent additive migration in either direction. For example, this layer can be a layer of A without cling additive or a layer of B without anticling material or any other barrier type thermoplastic resin. Further, as indicated above, the invention contemplates a multilayer film with layers of other functions between layers A and B.

In preparing the A/B extrudate of the present invention, any known prior art technique for coextruding the same can be employed. For example, the A formulation containing the appropriate amount of cling additive can be fed into the feed hopper of a conventional rotating screw extruder. The extruder screw employed can have a 6 inch (15 cm) diameter and a length to diameter ratio of about 24:1. A satellite extruder is employed for the extrusion of the B composition containing the appropriate amount of anti-cling agent. The satellite extruder comprises a conventional extruder having an extruder screw with a 3.5 inch (7.8 cm) diameter and a length to diameter ratio of about 24:1. Molten resin from the satellite extruder is fed into the cast film die affixed to the end of the A extruder through an adaptor specifically designed to join the B polymer stream from the satellite extruder to the molten A polymer stream so that it effectively interfaces with the molten surface of the A layer. A more complete description of this prior art process may be found in US—A—3,748,962.

Example 1

Employing the above described technique, an A/B coextrusion was formed composed of an 80% A layer thickness of a 3.0 M.I., 0.917 g/cm^3 density LLDPE containing polyisobutylene (number average M.W. 2060) in the ratio of 3 parts per 100 parts of LLDPE and a 20% B layer thickness of LDPE having a 2.0 M.I. of a 0.920 g/cm^3 density containing 5,000 PPM of a synthetic sodium aluminum silicate of the approximate formula Na_2O Al_2O_3 $2SiO_2$ $4H_2O$. The size of aggregates (DIN 51 033) was 3—4 µm. The slot coextruded film had a gauge of 0.9 mils (0.23 mm).

The resulting film had a cling force of 290 grams, cling surface to noncling surface. This represents an excellent cling force. Industry stretch wrap ranges from 70 grams for a no-tack stretch film to 500 to a stretch film with tackifier throughout. The resulting film also had a coefficient of friction, (dynamic) noncling layer to noncling layer of 0.8. This indicates there is no cling force and there is a slide property when the noncling surfaces are in contact with relative motion therebetween.

Example 2

A second A/B layer stretch film was a coextruded combination of a 90% A layer thickness having a 2.4 M.I., 0.917 g/cm^3 density LLDPE containing 2.4 parts per 100 parts of resin of polyisobutylene (number average M.W. 1300) and a 10% B layer thickness of a low density polyethylene having a 2.0 M.I., 0.920 g/cm^3 density resin containing 10,000 ppm amorphous silica having a particle size of 5—15 µm. The slot extruded film had a gauge of about 0.9 mils (0.23 mm).

This film had good A to B surface cling and no appreciable cling B to B.

Both films showed excellent stretch wrap characteristics in stabilizing loose loads and in addition the entire contacting surfaces remained in stretch wrap contact due to the cling of the outer A surface to the outer B surface. There is no cling between test contacted P surfaces. This permits effective and non-cling contact between wrapped adjacent loads.

Although the examples described a cast film process for the manufacture of the present stretch film products, it will be understood that other conventional thermoplastic film forming techniques for the preparation of stretch wrap may be employed, such as, tubular extrusion utilizing an entrapped air bubble to expand the extruded film tube. The stretch wrap film of the present invention should have a minimum stretch capability of 90% and typically will have a maximum stretch of about 300—400%.

Claims

1. A stretch wrap film having one-sided cling comprising a transparent thermoplastic A/B film structure wherein the exposed surface of layer A, in its stretched condition, has a comparatigely high cling force to the exposed surface of layer B and the exposed surface of layer B has at least substantially no cling force to a layer of itself and has a slide property when the exposed surface of layer B is in contact with a layer of itself with relative motion therebetween.

2. The film of Claim 1 wherein layer A contains a cling additive dispersed therein, the cling additive being of a character and in an amount sufficient to maintain film A, in its stretched condition, in cling-contact with layer B, and wherein layer B contains an anti-cling additive of a character and an amount sufficient to prevent at least any substantial cling force to a layer of itself.

3. The film of Claim 2 wherein layers A and B are polyolefins.

4. The film of Claim 3 wherein layers A and B are generically polyethylene.

5. The film of claim 4 wherein layer A comprises a linear low density polyethylene, the linear low density polyethylene consisting essentially of ethylene co-polymerized with a minor amount of at least one alpha-olefin having 4 to 10 carbon atoms and wherein layer B is a low density polyethylene.

6. The film of Claim 5 wherein the linear low density polyethylene has a density of from 0.905 to 0.940 g/cm^3 and a melt index of 1 to 6 and the low density polyethylene has a density of 0.905 to 0.940 g/cm^3 and a melt index of between 1 and 7.

7. The film of claim 6 wherein the linear low density polyethylene has been formed by copolymerization of ethylene with from 1 to 10% by weight of butene-1, 3-methyl-butene-1, hexene-1, 3-methyl-pentene-1, 4-methyl-pentene-1, 3-methyl-hexene-1, octene-1, decene-1 or a mixture thereof.

8. The film of claim 7 wherein the cling additive is a member selected from the group consisting of an amorphous atactic polypropylene having a number average M.W. of 2000, polyisobutylene having a number average M.W. of 1000 to 3000 grams per mole as measured by vapor phase osmometry, ethylene vinyl acetate copolymer, and a polyterpene.

9. The film of claim 7 wherein the anti-cling additive is a member selected from the group consisting of a highly subdivided silica and a silicate.

10. The film of claim 7 wherein the cling additive is a polyisobutylene and the anti-cling additive is a highly subdivided synthetic sodium aluminum silicate.

Patentansprüche

1. Streckverpackungsfolie mit einseitiger Haftung, die eine transparente, thermoplastische A/B-Filmstruktur aufweist, worin die freiligende Oberfläche der Schicht A in ihrer gestreckten Form eine vergleichsweise hohe Haftfähigkeit zur freiliegenden Oberfläche der Schicht B aufweist, und die freiliegende Oberfläche der Schicht B wenigstens im wesentlichen keine Haftfähigkeit zu einer gleichartigen Schicht und eine Gleitfähigkeit aufweist, wenn die freiliegende Oberfläche der Schicht B in Kontakt mit einer gleichartigen Schicht steht und dazwischen eine Relativbewegung stattfindet.

2. Folie nach Anspruch 1, worin die Schicht A ein in ihr dispergiertes Haftadditiv enthält, das nach Art und Menge ausreichend ist, um den Film A in seiner gestreckten Form mit der Schicht B in Haftkontakt zu halten, und worin die Schicht B ein Antihaftadditiv nach Art und Menge enthält, die ausreichen, wenigstens eine wesentliche Haftfähigkeit zu einer gleichartigen Schicht zu verhindern.

3. Folie nach Anspruch 2, worin die Schichten A und B Polyolefine sind.

4. Folie nach Anspruch 3, worin die Schichten A und B ihrer Gattung nach aus Polyethylen bestehen.

5. Folie nach Anspruch 4, worin die Schicht A ein lineares Polyethylen niedriger Dichte enthält, das im wesentlichen aus Ethylen besteht, das mit einer geringeren Menge von wenigstens einem α-Olefin mit 4 bis 10 Kohlenstoffatomen copolymerisiert wurde, und worin die Schicht B ein Polyethylene niedriger Dichte ist.

6. Folie nach Anspruch 5, worin das lineare Polyethylen niedriger Dichte eine Dichte von 0,905 bis 0,940 g/cm^3 und einen Schmelzindex von 1 bis 6 sowie das Polyethylen niedriger Dichte eine Dichte von 0,905 bis 0,940 g/cm^3 und einen Schmelzindex zwischen 1 und 7 aufweist.

7. Folie nach Anspruch 6, worin das lineare Polyethylen niedriger Dichte durch Copolymerisierung von Ethylen mit 1 bis 10 Gew.-%, 1-Buten, 3-Methyl-1-buten, 1-Hexen, 3-Methyl-1-penten, 4-Methyl-1-penten, 3-Methyl-1-hexen, 1-Octen, 1-Decen oder eines Gemisches davon hergestellt wurde.

8. Folie nach Anpruch 7, worin das Haftadditiv

aus der Gruppe, bestehend aus einem amorphen ataktischen Polypropylen mit einem Zahlenmittel des Molekulargewichts von 2000, einem Polyisobutylen mit einem Zahlenmittel des Molekulargewichts von 1000 bis 3000 Gram pro Mol, bestimmt durch Dampfphasenosmometrie, einem Ethylen-Vinylacetat-Copolymer und einem Polyterpen, ausgewählt wurde.

9. Folie nach Anspruch 7, worin das Antihaftadditiv aus der Gruppe, bestehend aus sehr fein zerkleinertem Siliciumdioxid und einem Silicat, ausgewählt wurde.

10. Folie nach Anspruch 7, worin das Haftadditive ein Polyisobutylen und das Antihaftadditiv ein sehr fein zerkleinertes synthetisches Natriumaluminiumsilicat ist.

Revendications

1. Un film d'emballage étirable dont une face présente un pouvoir accrochant qui est constitué d'un structure de film thermoplastique A/B, la surface exposée de la couche A, à son état étiré, exerçant une force d'accrochage comparativement élevée sur la surface exposée de la couche B et la surface exposée de la couche B n'exerçant sensiblement pas de force d'accrochage sur elle-même et qui présente des caractéristiques glissantes lorsque la surface exposée de la couche B est au contact d'une des ses proches couches en mouvement relatif par rapport à une couche semblable à elle-même.

2. Le film selon la revendication 1, dans lequel un additif d'accrochage est dispersé dans la couche A, cet additif d'accrochage étant d'un caractère propre et en quantités suffisantes pour maintenir le film A, à l'état étiré, en contact d'accrochage avec la couche B et dans lequel la couche B contient un additif anti-accrochage d'un caractère propre et en quantités suffisantes pour empêcher, au moins, toute force sensible d'accrochage de s'exercer sur elle-même.

3. Le film selon la revendication 2, dans lequel les couches A et B sont des polyoléfines.

4. Le film selon la revendication 3, dans lequel les couches A et B sont génériquement du polyéthylène.

5. Le film selon la revendication 4, dans lequel la couche A comprend un polyéthylène linéaire basse densité, essentiellement constitué d'éthylène copolymérisé avec une quantité mineure d'au moins une alpha-oléfine renfermant de 4 à 10 atomes de carbone et dans lequel la couche B est un polyéthylène de basse densité.

6. Le film selon la revendication 5, dans lequel le polyéthylène linéaire basse densité a une densité comprise entre 0,905 et 0,940 g/cm^3, son indice de fusion étant compris entre 1 et 6 et le polyéthylène de basse densité ayant une densité de 0,905 à 0,940 g/cm^3 et un indice de fusion compris entre 1 et 7.

7. Le film selon la revendication 6, dans lequel le polyéthylène linéaire basse densité a été obtenu par copolymérisation d'éthylène avec de 1 à 10% en poids de butène-1, 3-méthyl-butène-1, hexène-1, 3-méthyl-pentène-1, 4-méthyl-pentène-1, 3-méthyl-hexène-1, octène-1, décène-1 ou un mélange de ces monomères.

8. Le film selon la revendication 7, dans lequel l'additif d'accrochage est comprise dans le groupe formé par un polypropylène atactique amorphe d'un poids moléculaire moyen de 2 000, un polyisobutylène d'un poids moléculaire moyen de 1 000 à 3 000 g par mole, ceci étant mesuré par osmométrie en phase vapeur, un copolymère éthylène/vinylacétate et un polyterpène.

9. Le film selon la revendication 7, dans lequel l'additif anti-adhésif est choisi dans le groupe constitué par un silicate ou une silice hautement subdivisé.

10. Le film selon la revendication 7, dans lequel l'additif d'accrochage est un poly-isobutylène et l'additif anti-accrochage est un silicate d'aluminium-sodium synthétique hautement subdivisé.